8th annual meeting of the European Society for Molecular Imaging – ESMI
European Molecular Imaging Meeting – EMIM 2013
26 to 28 May, 2013 | Torino Incontra - Centro Congressi | Via Nino Costa 8 | Torino, Italy

PO 06 | Technology / Methodology II
Type: Poster Session
Chair: Bernd Pichler (Tübingen), Kai Licha (Berlin)
Date: May 28, 2013
Time: 9:00 - 10:30

Design and Implementation of Forward algorithm based on Finite Element Method for Fluorescent Molecular Tomography (#284)

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Introduction

Optical imaging is established as one of the modalities applied to molecular imaging studies. Molecular imaging can be used to visualization of molecular events in the cellular or sub cellular level. The cell function can be shown by using fluorescent and suitable wavelength of optical radiation. Among the different methods of optical imaging Fluorescent Molecular Tomography (FMT) is a non-invasive method for imaging the biological tissue at cellular level. The goal of this study was developed of a fast algorithm for forward problem based on finite element method for 2-D geometry.

Methods

The aim of present study was determination the fast algorithm for forward problem that is used in image reconstruction of FMT system. For this purpose diffusion equation was solved by using finite element method which is the fast, accurate and flexible technique. The air-tissue boundary was presented by Robin boundary condition. A 2-D circular mesh with linear triangular elements was used. The source and detectors were located on the boundary. The fluorescent target placed at center of mesh. The algorithm based on FEM to solve the diffusion approximation was developed and written in the MATLAB programming to measure the intensity on the nodal boundary pointes and evaluated by the NIRFAST software.

Results

The intensity of nodal boundary pointes was measured at each $30^0$for tomography imaging. The FEM algorithm of diffusion approximation which was developed at this study was compared with NIRFAST. These results show the good agreement between the FEMDA code with NIRFAST. Although the error was low but the most of error is located near the source term. Here just has been shown the result of 0^0. Figure (1) and figure (2) show the FEMDA matches with NIRFAST for the mesh without fluorescent and the mesh with fluorescent.

Conclusions

The FEDA algorithm shown that FEDA yields similar results to NIRFAST for the

2-D geometry.The results showed the significant correlation coefficients (R >0.95), which demonstrated the high accuracy of the algorithm. The algorithm which is designed and developed in this study is more fast, flexible and accurate. The computation time was low. This algorithm gives the user the flexibility to modify every aspect of the model, including element shape, basis functions, boundary conditions, and diffusion approximation equation. The suggested algorithm can be used for image reconstruction of FMT system and can be modified to 3-D geometry.

Keywords: Diffusion Equation, Finite element, Fluorescence imaging